

**ORIGINAL ARTICLE**

## Factors influencing the frequency of malnutrition among children aged between 6 to 59 months in the Ouaddaï Province of Chad

<sup>a</sup>Roumane Moukhtar / <sup>b</sup>Oumarou DiadieHalima / <sup>\*b,c</sup>Tidjani Abdelsalam / <sup>d</sup>Papin Miantom / <sup>e</sup>Balla Abdourahamane /

**Authors' Affiliation**

<sup>a</sup>Institut National Supérieur des Sciences et Techniques d'Abéché (INSTA), Tchad

<sup>b</sup>Département des Productions Végétales, Faculté d'Agronomie, Université Abdou Moumouni, Niamey-Niger

<sup>c</sup>Faculté des Sciences de la Santé Humaine (FSSH), Université de N'Djamena, Tchad

<sup>d</sup>Institut National Supérieur des Sciences Agronomiques et des Technologies Agroalimentaires de Laï (INSATAL), Tchad

<sup>e</sup>Centre Régional d'Enseignement Spécialisé en Agriculture (CRESA), Université Abdou Moumouni, Niamey-Niger

**Corresponding author**

Abdelsalam Tidjani

Email: [abdelti@gmail.com](mailto:abdelti@gmail.com)

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**Abstract**

The aim of this study was to determine the factors that influence the prevalence of malnutrition in children aged between 6 to 59 months in the Ouaddaï province, Chad by assessing the nutritional status of children, and the living standards in households, the individual dietary diversity, the hygienic practices and Infant and Young Child Feeding (IYCF) practices. This is a descriptive cross-sectional prospective study that involved a total of 185 children aged from 6 to 59 months with their respective mothers. This study was conducted using a structured questionnaire for children's mothers to collect data on sociodemographic and socioeconomic parameters, 24-h individual dietary diversity, hygienic practices and IYCF. The nutritional status was assessed using targeted anthropometric parameters on children according to the World Health Organization (WHO). These standards allowed classifying children by name and by calculating the prevalence of acute, chronic malnutrition and underweight. A significant chi-square test of the 5% threshold was used to see the links between the main study variables.

Results showed that 10.3% of children were emaciated, 38.9% suffered from chronic malnutrition and 33.0% suffered from underweight. Among these children, 47.6% are from precarious household, 58.3% practice poor food hygiene, 91.4% were lit mixed, 62.7% were abruptly weaned and 47.1% received complementary foods below 6 months of age. The analyses showed that the factors that have a significant influence on malnutrition, especially on the low nutritional status of children, are the birth order, the living standards in households, the hygienic practices, the IYCF and the Dietary Diversity Score (DDS) ( $p < 0.05$ ).

**Practical application**

Malnutrition is a public health problem in developing countries in general and it is endemic in the Sahelian region of Africa. The fighting against malnutrition in all its forms must be multisectorial and multidisciplinary. Collaboration from all sectors and at all levels is very important to improve the nutritional status of Children in the world.

**Keywords:** *Factors, Malnutrition, Children, Food practices, Ouaddaï, Chad.*

**1. Introduction**

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients (WHO, 2020). It affects children more because of the qualitative and quantitative importance of the nutrients they need for rapid

growth (Aubry & Bernard, 2016). Malnutrition by deficiency is a form of pathologies that expose children to specific illnesses or infections and hinders the good development of the physical and mental potentials of children. Malnutrition occurs very early and affects children at any age. The critical phase of child growth is the weaning



period (Sellam & Bour, 2015). At the global level, about 155 million children under 5 suffer from chronic malnutrition and 52 million suffer from acute malnutrition, with about 17 million of them severely affected (FAO *et al.*, 2017). As a result, 2.7 million of the 5.6 million of world deaths of children under five (5) is due to malnutrition by deficiency. In Africa, the prevalence of stunting in children below 5 is 31.2% and underweight 37.4%. Sub-Saharan Africa remains the region of the world with the highest mortality rate among children under 5. Inequalities persist in countries following geographical areas and socioeconomic conditions (WHO, 2017).

In Chad, the national prevalence of overall acute malnutrition is 13.9% among children under 5, and the severe form is 3.9%, which is far above the 2% emergency threshold mentioned by World Health Organization (WHO) (INSEED & MSP, 2017). The proportion of underweight is 27.4%, where the moderated form represents 18.1% of kids below 5 and the severe form 9.3%. In addition, chronic malnutrition is estimated at 32.4% in general, which is above the WHO threshold of 30% (INSEED & MSP, 2017). Despite efforts by the government of Chad and its partners to reduce the prevalence to malnutrition in children aged between 6 to 59 months, the nutritional situation remains alarming. In addition, new information and data on the malnutrition status of children aged between 6 to 59 months at the Ouaddaï province of Chad are not available. Based on this situation, this study was conducted with the objective of assessing the nutritional status of children aged 6 to 59 months in order to understand the factors responsible for malnutrition within this group in Ouaddaï province.

## 2. Materials and Methods

### 2.1. Type and period of study

This work is a prospective, cross-sectional study that took place in March 2018 in the Ouaddaï province, eastern Chad. The studied population was composed of mothers with their children aged between 6 to 59 months.

The cluster sampling method was applied at three levels, with random districts selection as the first level and random selection of neighborhoods as second level. The children and their mothers were randomly chosen from the last level.

### 2.2. Sampling

The sample size was calculated with the ENA\* for SMART\* 2011 software so that malnutrition appears above the table size. This ratio contains 14.2% [10.2-19.4], IC 95% confidence level, a desired 5% accuracy, and a cluster effect of 1.5. A total of 185 children with their respective mothers were surveyed after obtaining consent of each mother. The study started on March 03, 2018 and ended on July 13, 2018.

### 2.3. Data collection

Permission to collect data in the Ouaddaï province was given by the local authorities. The collection was done in two phases through a structured questionnaire. The collected data were centered on the sociodemographic and socioeconomic characteristics of households as well as the individual daily dietary diversity and the hygienic practices and IYCF. The sociodemographic information collected was the following: sex, age and date of birth. The socioeconomic characteristics were collected and analyzed according to the methods of Christian & Charles (2000) and were focused on the type of habitat, the process of drinking water supply,

soil characteristics, restrooms and the type of energy used for the lighting.

The daily Dietary Diversity Score was collected and assessed according to the FAO method (FAO, 2013). The children were classified into three groups. The first group included those with low dietary diversity (1-2 groups of foods consumed daily), the second those with average (3-4) and the third those with adequate dietary diversity (4 and more).

The hygienic practices of households were evaluated using 5 key rules listed below for a safe diet. Firstly, hands must be cleaned as well as surfaces and equipments used for food preparation. Secondly, raw foods must be separated from the other foods and utensils and cutting boards should be clean. Thirdly, foods, including beef, goat, mutton, poultry, eggs, fish and seafood should be well cooked. Fourthly, food should be stored at the right temperature and finally water and healthy products should be used for preparation and consumption.

The practices of food hygiene are qualified as good when the household respects these 5 rules and bad when the household does not follow them. IYCF practices grouped all practices ranging from feeding at birth to the age of introduction of complementary foods and continued breastfeeding. They were collected from mothers through a questionnaire, according to the methods applied by INSEED (2016).

The anthropometric data were collected in the second phase using a weighing scale (UNISCALE) of 150kg capacity with 0.1kg precision. A 100 cm height rod was used to record the height of the targeted children. To weigh each child, the scale was calibrated every morning. Skillful children were removed and placed on the scale. The reading was done with

an accuracy of 100 g. The size was measured using a local scale ( $150 \pm 0.1$  cm), according WHO recommendations (WHO, 2006). Here, the size was taken by lying down (length) the children under 2 on the scale while the same parameter was taken for those above 2 in a standing position. Weight and height were compared with the age of the children, referring to the WHO standards (WHO, 2006) according to their gender in order to obtain the Z-scores of the weight / height, height / age and weight / age indexes. This helped to classify the children according to their Z-score for the above mentioned parameters. Those whose the Z-score of one of the indexes was deviating from the median of the standards were identified as malnourished and classified according to the severity of the malnutrition: slight ( $<-1$  standard deviation / SD of the value median), moderate ( $<-2$  SD) or severe ( $<-3$  SD).

#### 2.4. Data processing and analysis

SPSS software version 23.0 was used for processing and analyses of the data collected. Study variables were created and encoded. For anthropometric data, the nutritional indexes defining malnutrition in children were treated with ENA for SMART software version 2011, with WHO (2006) standard. The Pearson chi-square test was used to compare the qualitative variables and was considered significant at the threshold  $\alpha=5\%$ . To get the measure of association between the independent variables and the dependent variables, a cross-tab was built with this software to obtain p values.

The relationship between malnutrition and independent variables is analyzed as follows: For each of the three anthropometric indexes (Weight/Height, Height/Age and Weight/Age), each child was first classified according to

whether or not they were below -2 Z-score of WHO standards. Subsequently, a variable called "malnourished/non-malnourished" was created as follows: if the child had a Z-score score below -2 for any of the indexes, he or she was classified as malnourished; if the child had a Z-score equal to or higher than -2 Z score, he was considered to be non-malnourished.

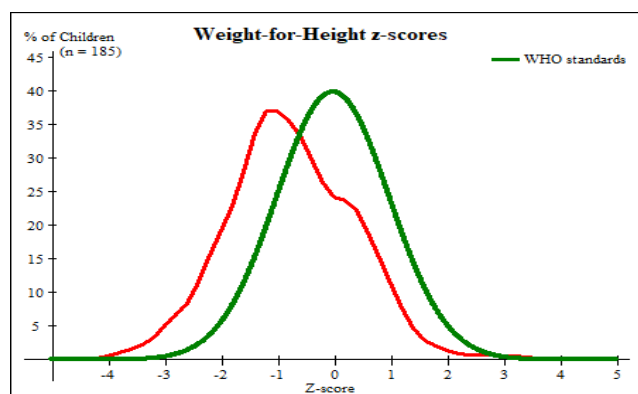
This variable was used for bi- and multivariate analyzes to assess the relationship between malnutrition and the variables of interest in this study.

### 3. Results and Discussion

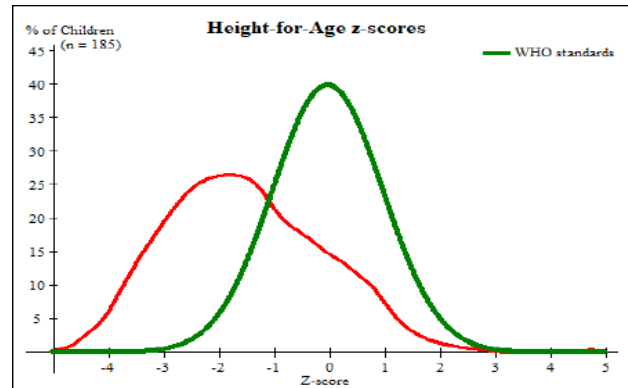
#### 3.1 Results

##### 3.1.1. Nutritional indexes of children surveyed in relation with WHO standards

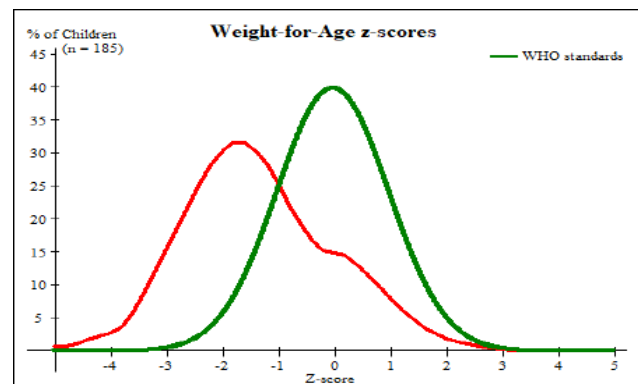
Figures 1, 2 and 3 show the distribution of the nutritional indexes of the children surveyed against the WHO standards. In these figures, it can be observed that the red curve is shifted at the left compared to the green one (WHO standard).



**Figure 1:** Distribution of the Z-score Weight/ Height index of children aged between 6 to 59 months (n=185) in the Ouaddaï Province compared to the WHO standard.



**Figure 2:** Distribution of the Z-score Height /Age index of children aged between 6 to 59 months (n=185) in the Ouaddaï Province compared to the WHO standard.



**Figure 3:** Distribution of the Z-score Weight /Age index of children aged between 6 to 59 months (n=185) in the Ouaddaï Province compared to the WHO standard.

##### 3.1.2 Nutritional status of children

The assessment of the nutritional status of the children surveyed was used for the calculation of Z-scores and classify the nutritional status of children according to the type of malnutrition and their severity. The results obtained are shown in table 1.

**Table 1:** Classification of the nutritional status of children by the Z-score calculated based on WHO standards

Index	Indicators	Z- score	Degree	Number	Percentage (%)
<b>Weight for Height</b>		<-3/edema	Severe	03	1.6
Acute malnutrition	Emaciation	<-2 and ≥ -3	Moderate	16 19	8.7 <b>10.3</b>
Normal state		<-2/edema	Global	166	89.7
<b>Height for age</b>	Growth delay	<-3	Severe	26	14.1
Chronic Malnutrition		<-2 and ≥ -3	Moderate	45 71	24.9 <b>38.9</b>
Normal state		<-2	Global	114	61.1
<b>Weight for age</b>	Underweight	<-3	Severe	11	5.9
Low weight		<-2 and ≥ -3	Moderate	50 61	27.0 <b>33.0</b>
Normal state		<-2	Global	124	67.0

Anthropometric analysis revealed that 10.3% of children aged between 6 to 59 months are emaciated, 38.9% suffered from chronic malnutrition, and 33.0% underweight.

### 3.1.3 Relationship between household standard of living and malnutrition

Table 2 presents children's distribution according to the living standards in households. The multivariate analysis revealed that about one out of every two malnourished children (47.6%) live in precarious households (low living standard : lack of tap water, electricity, outdoor cement and modern or improved restrooms) while 34.0% live in households with moderated living standards (with tap water, cemented floors or improved restrooms or access to electricity). However, no malnourished child came from households with high living standards. In addition, the chi-square test confirmed the existence of a statistically significant link

between malnutrition and household living standard ( $p = 0.003$  which is less than 0.05) at the 5% threshold.

### 3.1.4 Relationship between malnutrition and household food hygiene practices

The children are distributed in the following table according to food hygiene practices of households in which they live. Food hygiene is considered good when the household respects the 5 key rules for safe and bad when the rules are not respected. The results obtained are shown in table 3.

It can be observed that over 39.7% of children from mothers complying with food hygiene rules, 23.2% are malnourished and 16.5% are not. But more than half of malnourished children (58.3%) have mothers who do not respect the food hygiene key rules. The low nutritional index is linked to the hygienic practices of children's mothers of  $p < 0.05$ .

**Table 2:** Distribution of children by household living standards

Household standard of living	Malnourished children		Non-Malnourished children		Total	
	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
Low	88	47.6	02	1.1	90	48.7
Average	63	34.0	05	2.7	68	36.7
High	00	00	27	14.6	27	14.6
<b>Total</b>	<b>151</b>	<b>81.6</b>	<b>34</b>	<b>18.4</b>	<b>185</b>	<b>100</b>

**Table 3:** Children's distribution of (n=185) according to household food hygiene practices

Food hygiene	Malnourished children		Non-malnourished children		Total	
	Number	Percentage (%)	Number	Percentage (%)	Number	Percentage (%)
Good	43	23.2	31	16.5	74	39.7
Bad	108	58.3	03	2.0	111	60.3
<b>Total</b>	<b>151</b>	<b>81.5</b>	<b>34</b>	<b>18.5</b>	<b>185</b>	<b>100</b>

### 3.1.5 Link between infant and young child feeding practices and malnutrition

Table 4 presents the proportion of children according to Infant and Young Child Feeding (IYCF) practices. By analyzing this table, we can first affirm that many children received colostrum at birth representing a percentage of 84.3%. On the Other hand, 15.7% of children have received at birth either water and decoctions. Only 3.2% of children were breastfed exclusively for 6 months, compared to the majority who received the blend 91.4% artificial milk and 5.4% breastmilk. The Chi-square gives a value of  $p = 0.024$ .

So the influence of breastfeeding type on malnutrition is significantly strong. As for weaning, more than half of the children were weaned abruptly (62.7%), and 37.3% were weaned out gradually. So the link between malnutrition and type of weaning is significant ( $p = 0.031$ ). The proportion of children who received food at the age of 6 months is 47.1%. It was noted that 32.9% of children received below 6 months of age. Children who received food at an age greater than 6 months represented 20.0%. The chi-square test carried out on weaning age and malnutrition shows a value  $p = 0.014$ . In addition, 51.4% of children do not finish their



meal according to the statement of their mothers against 48.6% who finish or consume at least half of the given dishes. However, the relationship with their nutritional index is not significant  $p > 0.05$ .

It can be noted that out of 7 defined food groups, the majority of Children (70.2%), had an average score of 3 to 4 food groups consumed on the eve of the survey. In contrast, 13.1% of children have a high score of at least five food groups, while others have a low dietary diversity score of 16.7%.

**Table 4:** Children's distribution of according to mothers' IYCF practices (N = 185)

Variables	Modalities	Total (N=185)	Percentage	p-value *
Colostrum	Colostrum received	156	84.3	0.024
	Water/decoction received	29	15.7	0.009
	<b>Total</b>	<b>185</b>	<b>100</b>	
Type breastfeeding	Exclusive 6 months	06	3.2	0.001
	Mixte Mixed breastfeeding	169	91.4	0.024
	Artificial breastfeeding	10	5.4	0.024
	<b>Total</b>	<b>185</b>	<b>100</b>	
Duration of breastfeeding	< 2 years	113	61.1	0.002
	At 2 years	55	29.7	0.071
	>2 years	17	9.2	0.222
	<b>Total</b>	<b>185</b>	<b>100</b>	
Type of weaning	Brutal weaning	116	62.7	0.011
	Gradual weaning	69	37.3	0.014
	<b>Total</b>	<b>185</b>	<b>100</b>	
Age of introduction of complementary foods	< 6 months	88	47.1	0.916
	At 6 months	60	32.9	0.023
	> 6 months	37	20.0	0.333
	<b>Total</b>	<b>185</b>	<b>100</b>	
Quantity of food	Satisfactory	90	48.6	0.0507
	Unsatisfactory	95	51.4	0.0791
	<b>Total</b>	<b>185</b>	<b>100</b>	

<: Less than

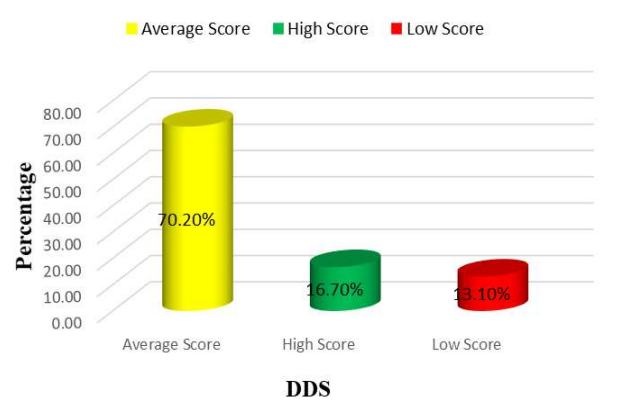
>: better than

\*p-value: obtained through Pearson x2

This 24-h dietary diversity has an influence on malnutrition because the test indicates a value  $p = 0.041$ .

### 3.1.6 Relationship between 24-hours dietary diversity and malnutrition

Figure 4 shows the children's distribution according to their individual dietary diversity scores.



**Figure 4:** Surveyed children's distribution according to the individual dietary diversity score (n=185) DDS: Dietary diversity scores

### 3.4 Discussion

Anthropometric analysis revealed that 10.3% of children aged between 6 to 59 months were emaciated, 38.9% suffered from chronic malnutrition, and 33.0% were underweight in the Ouaddaï province. The results are comparable to those obtained in the same province by the demographic and health survey of 2014-2015 with respective prevalence of 20.9%, 43.0%, and 37.2% (INSEED, 2016). This suggests that the previously adopted control strategies have not been able to reduce the scourge. It also results that all malnourished children come from households with a low and average standard of living, respectively 47.6% and 34.0% out of a total of 81.6% of the malnourished children enrolled during the study. Thus those children who are victims of malnutrition, particularly acute, come mainly from precarious habitats. Similar results were obtained by Kouamé *et al.* (2017) in Ivory Coast and Thiam *et al.* (2018) in Senegal. Like in the present study, the latter did not record any malnourished children belonging to households with water, electricity, household appliances and children's room. In addition, the living conditions of a poor family are

characterize not only by the lack of the necessary infrastructures and equipments in the household but also by an unhealthy diet to which are added the poor hygienic conditions. Insufficient food intake in quantity and quality can tip a child into malnutrition. The DDS of 70.20% of the children surveyed is average and composed mainly of processed cereals and sugars. However, this 24-hour dietary diversity has an influence on malnutrition ( $p=0.041$ ). Haltoly *et al.* (2000) have shown that increasing the dietary diversity goes with better socio-economic status and food security level of household. Regarding the IYCF practices, the link with the Z-score below -2 for all of the indexes presented by the children is statistically significant ( $p<0.05$ ). Comparable results were obtained by INSEED (2016) at the national level, where 86.7% of children received other foods before breastfeeding while 98.1% were breastfed mixed. Thus, the relationship between Z-score less than -2 for either index and withdrawal practice is significant ( $p<0.05$ ).

### 4. Conclusion

This research aimed at evaluating the factors influencing malnutrition among children aged 6 to 59 months in the Ouaddaï province. The high prevalence of malnutrition found highlights the existence of a serious nutritional situation. Household living standards, food and hygiene practices and daily dietary diversity significantly influence malnutrition among children aged from 6 to 59 months in the Ouaddaï province. We can therefore state that socio-economic and socio-demographic factors are the main parameters that influence child malnutrition in the Ouaddaï province. This study is a tool to help decision-making. It is therefore necessary to intervene by acting on these factors to effectively fight against malnutrition in all its forms, especially in



children aged between 6 to 59 months. The causes of children malnutrition are therefore multidimensional, complex and interdependent.

### Conflict of interest

The authors declare that there are not conflicts of interest.

### Ethics

This Study does not involve Human or Animal Testing.

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